

Should the Examiner have any questions regarding the amendments or response, the Examiner is encouraged to contact the undersigned by telephone for clarification and for expeditious resolution of the issues.

Amendments Under 37 C.F.R. 1.116

IN THE CLAIMS

Please amend the claims as shown in Appendix A (marked-up version), attached hereto. A clean copy of the amended claims is provided in Appendix B.

REMARKS

A. Concerning the Amendments

Claim 1 has been amended to specify that the catalyst is to be used in "an oxidation process in the presence of hydrogen." Support for this amendment is found at page 18, lines 15-20, of the specification.

Claim 10 has been amended to characterize the organotitanium compound as one having a titanium-carbon σ (sigma) or π (pi) bond. Support for this amendment is found at page 9, lines 1-7, of the specification.

B. Concerning the Rejection of Claims 1-9 and 18-32 Under 35 U.S.C. §103(a)

Claims 1-9 and 18-32 stand finally rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Haruta et al. (US 5,051,394, hereinafter "Haruta '394") in view of Iwakura et al. (US 5,502,020, hereinafter "Iwakura"), for the reasons of record. This final rejection, as it may pertain to amended Claims 1-9 and 18-32, is traversed for the following reasons.

At the outset, it is noted that Claim 1 has been amended to specify that the catalyst prepared by the claimed process is to be used in an oxidation process in the presence of hydrogen (hydro-oxidation process).

The Examiner argues that the references meet the standards of *In re Oetiker*, because the references lie in the field of Applicant's endeavor, or if not, then reasonably pertinent to the particular problem with which Applicants were concerned. A "reasonably pertinent reference" is one, which even though in a different field from that of the inventor's endeavor, is one which, because of the subject matter, would

logically have commended itself to an inventor's attention. *In re Oetiker* and *In re Clay*, 966 F.2d 656, 659; 23 USPQ2d 1058, 1061 (Fed. Cir. 1992). The Examiner describes the endeavor generically as "to make a catalyst." In view of the amendment to Claim 1, the field of endeavor is limited to preparing a catalyst for a particular use, namely, an oxidation process in the presence of hydrogen. Clearly, Iwakura does not meet the standards of *In re Oetiker*, because, as evidenced hereinafter, Iwakura is not in the field of Applicants' endeavor nor would it have logically commended itself to the inventor's attention.

Iwakura very clearly pertains to an impregnation process of preparing a catalyst containing silver, cesium, and tungsten for use in the direct oxidation of ethylene (a C₂ hydrocarbon) with oxygen to form ethylene oxide. Iwakura is silent with respect to hydrogen in the oxidation feedstream. Iwakura buries mention of gold only as a subsidiary element in a laundry list of about 48 metallic elements. In contrast, the claims are concerned with preparing a catalyst containing gold as one of two primary active components (Au-Ti), with no requirement for active components of silver, tungsten, or cesium. Moreover, the gold-titanium catalyst is required to be active for use in an oxidation process in the presence of hydrogen (hydro-oxidation process). Further, Applicants' specification clearly directs examples to the hydro-oxidation of C₃ and higher olefins. All of these differences between Iwakura and the instant application and claims are art-recognized differences as evidenced, for example, by the references supplied to the Examiner in Applicants' Response B filed on October 9, 2002. Accordingly, Iwakura lies at a significant distance from Applicants' field of endeavor. Moreover, in consideration of the unpredictability of the field of catalysis (*vide infra*), Iwakura is not reasonably pertinent to the problem with which Applicants were concerned. For these reasons and inasmuch as Iwakura buries gold in a laundry list, Iwakura would not have logically commended itself to the inventor's attention. It is again requested that Iwakura be withdrawn.

Case law further establishes that when a rejection depends upon a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *Ecolchem, Inc. v. Southern Cal. Edison Co.*, 227 F.3d, 1361, 56 USPQ2d. 1065 (FC 2000). *In re Nilssen*, 851 F.2d. 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) The Examiner admits that reliance is made on

Iwakura, not Haruta '394 for a teaching of impregnation, further supported by Iwakura's teaching of selective and active catalysts. Iwakura's teachings are specifically drawn to catalysts containing silver, cesium, and tungsten for a direct oxidation process, with no mention of hydrogen. Neither Iwakura nor Haruta '394 provides additional teachings or suggestions that would extend impregnation to the preparation of different catalysts (gold-titanium) for a different purpose (hydro-oxidation). Given that the field of catalysis is very unpredictable, no expectation can be had of a positive outcome in preparing the gold-titanium catalyst with which Applicants were concerned. (*Vide infra.*) Thus, the required motivation is lacking; moreover, "obvious to try" is not the standard under 35 U.S.C. §103. *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

While the arguments below have been presented before, Applicants present them again in light of the claim amendments set forth herein and with a view towards preserving Applicants' right to appeal, should that be necessary.

The Examiner regards Applicants' admission that impregnation is a well-known technique in the art as supportive of the rejection. The admission that a chemical processing technique is generally well-known does not, in and of itself, provide suggestion of applicability and beneficial outcome in particular untried circumstances. An element of unexpected effect can be discovered when applying well-known techniques to the solution of specific problems. In the instant case, Applicants unexpectedly discovered that *when the elements of impregnation and a reducing agent are combined*, then the process of preparing a gold-titanium hydro-oxidation catalyst is greatly simplified ---to the point of being commercially feasible-- - while maintaining good activity and high selectivity of the catalyst. At best, Applicants' admission that impregnation is a well-known technique may only be supportive of "obvious to try," which as noted above is not the standard under 35 U.S.C. 103.

The Examiner states, "No cited reference teaches that impregnation cannot be used or should be avoided." This viewpoint remains improperly limited by the references cited and does not consider the teachings of the art "taken as a whole." All evidence of non-obviousness must be considered when assessing patentability. *In re Soni*, 34 USPQ2d, 1684, 1687 (Fed. Cir. 1995). The Examiner's attention is drawn

once again to EP-A1-0,709,360 (of record), which discloses impregnation of a titania support with a gold compound, *but with no reducing agent*, to prepare a gold-titanium composition that is then shown to be *inoperable in a hydro-oxidation process* similar to the type exemplified in Applicants' specification. (If the Examiner does not fully understand this reference and the implications thereof, then the undersigned would be more than willing to explain these teachings in a telephone conference call with the Examiner.) For obviousness, there must be a reasonable expectation of success. The failure of others may be presented as evidence of non-obviousness. *In re O'Farrell*, 853 F2d. at 903. Applicants maintain that EP-A1-0,709,360, more than any other reference, teaches *failure* of impregnation as tried by others and therefore teaches away from the most commercially attractive route in preparing gold-titanium catalysts for hydro-oxidation processes. Accordingly, the discovery claimed by Applicants does not flow naturally from the suggestion of the prior art "taken as a whole;" and Applicants' results stand as an unexpectedly beneficial outcome in contrast to the prior art.

Regarding Claim 1, the Examiner rejects the argument that Haruta '394 is teaching away from the use of reductants. Applicants' evidence rests on an unambiguous quote from Haruta '394: *"The reductant addition method of 4) has a disadvantage in that when the specific surface area of the metal oxide carrier is small or when the amount of gold loading is increased, for example, the dissolved gold compound is reduced to form metal particles in solution and is not utilized effectively in the deposition of the ultrafine gold particles on the support oxide, and consequently production costs rise."* (Haruta '394, column 2, lines 47-54) How can that quotation teach to anything other than away from reductants? Moreover, Haruta '394 teaches to a different function for their use of carboxylic acid ("protective fence" not a reducing agent), further supporting "teaching away." Applicants' claims are patentable, because the disclosed disadvantaged use of reductant has been *unexpectedly* turned around to advantage by Applicants in their selection of the impregnation method combined with the use of a reductant. The claimed combination of elements eliminates the problems of forming gold particles in solution, of under-utilizing gold, and increased production costs for gold recovery, while offering a commercially attractive method of producing a Au-Ti catalyst that is acceptably active and selective for oxidation processes in the presence of hydrogen. This unexpected result does not

flow naturally from the prior art, because the art is replete with process techniques and catalytic components, but lacks any indications as to which selection of techniques or elements might be beneficial to solve the specific problem at hand. Applicants were the first to recognize that the particular selection of impregnation with use of a reductant yields the sought-after solution to the problem of having a commercially attractive method of preparing Au-Ti hydro-oxidation catalysts.

Regarding Claims 4 and 5-7, the Examiner argues that Haruta '394 discloses reduction with carboxylic acid. As noted above, Applicants believe that Haruta '394 teaches away from reduction as problematical and describes the function of the carboxylic acid rather as a "protective fence" to keep the gold from agglomerating. Given the scope of the art, it would not have been obvious to combine a reducing agent with impregnation, as Applicants have done, to avoid the problems Haruta describes. (*Vide supra.*)

With regard to Claims 22, 23, 24, and 27, the Examiner argues that Applicants do not claim a step wherein sodium is preserved. This is also not precisely true. The Examiner's attention is drawn to Claim 27, drawn to a process wherein after impregnation and washing, the support is then treated with a solution of at least one promoter metal. Moreover, in the specification at page 17, lines 30-33, continuing onto page 18, lines 1-3, Applicants write that after washing the support may be treated with a solution of promoter metal ions "to replenish the promoters that may have been lost during the preceding washing." In Applicants' examples, the catalysts are prepared in a variety of ways to preserve the promoter metals: washing with methanol, which does not substantially dissolve the promoter metal salts; or removal of impregnation solution under rotary evaporation with no subsequent washing; or washing with water following by a final wash with a sodium salt. As to Applicants' Example 4 the catalyst (13.4 g) is submerged in three 100-ml samples of doubly deionized water, which corresponds to a total of only 22.5 ml H₂O/g catalyst (or only 7.5 ml H₂O/g catalyst per wash), which should not be considered by one skilled in the field to be a "thorough washing." Moreover, in Example 4, the promoter (in this case potassium) is preserved in the finished composition, as noted: K/Au atomic ratio of 2.4/1 (specification, page 26, lines 15-16).

With respect to Claims 10, 13, 14, 19, and 21, Applicants maintain their argument that no technical nexus exists between a reducing agent and a catalyst support; hence, it would not be obvious to one skilled in the art to select the titanium of the catalyst support and use it in the reducing agent.

With regard to Claims 11 and 12, Applicants have amended these claims to characterize the organotitanium compound as one having a titanium-carbon σ -bond (sigma bond) or π -bond (pi bond). The carboxylic acids and salts of Haruta '394 are characterized by an ionic bond between metal ion and oxygen (oxide) (M^+O^-). No compound having a titanium carbon σ -bond or π -bond is disclosed or suggested by Haruta '304 or Iwakura.

With regard to Claim 28 which depends from amended Claim 1 and relates to impregnation to the point of incipient wetness, novelty and unobviousness are predicated on the whole claim, including the requirements for impregnation and a reducing agent for preparing a gold-titanium catalyst for use in an oxidation process in the presence of hydrogen. The claim limitations taken in their entirety argue in favor of withdrawing Iwakura, which relates to using impregnation for preparing a silver catalyst for a different use.

In view of the amendment to Claim 1 and the arguments set forth hereinabove, it is submitted that amended Claims 1-9 and 18-32 are clearly unobvious over Haruta '394 in view of Iwakura. Accordingly, it is respectfully requested that the Final Rejection under 35 U.S.C. §103 be withdrawn.

C. Concerning the Rejection of Claims 10-14 and 16 Under 35 U.S.C. §103(a) Over Haruta '394 in view of Iwakura and Hirose et al.

Claims 10-14 and 16 stand finally rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Haruta '394 in view of Iwakura further in view of Hirose et al. (US 5,532,030), for the reasons of record. This rejection, as it might apply to Claims 10-14 and 16, is traversed for the following reasons.

In the Final Rejection, the Examiner is not persuaded to remove Iwakura and Hirose as references. In reply, Applicants have amended Claim 1 to limit the gold-titanium catalyst composition for use in an oxidation process in the presence of hydrogen. Claims 10-14 and 16 depend from amended Claim 1. By amending the

claims to the aforementioned specific use, both Iwakura and Hirose stand well outside the field of the endeavor -----Iwakura for the reasons given in Section B hereinabove and Hirose because it pertains to titanyl acetylacetonate being used itself as a catalyst in an olefin polymerization process. Nowhere do Iwakura and/or Hirose disclose, suggest, or hint at the use of titanyl acetylacetonate as a reducing agent to be used in the preparation of gold-titanium catalysts for employment in an oxidation process in the presence of hydrogen. "Obvious to try" cannot defeat a claim. It is again requested that both Iwakura and Hirose be withdrawn.

Further to the rejection, amended Claims 11 and 12 are clarified to state that the organotitanium compound is characterized as having a Ti-C σ -bond or π -bond. Haruta discloses metal ion carboxylates, which would inherently contain metal ion-oxide ionic bonds. Iwakura adds nothing to the rejection; and Hirose does not suggest using titanyl acetylacetonate as anything other than a polymerization catalyst. Accordingly, there are no teachings, suggestions, or hints to employ sigma or pi bonded Ti-C compounds as reducing agents in the preparation of gold-titanium compounds for use in hydro-oxidation processes.

In view of the above, it is submitted that amended Claims 10-14 and 16 clearly meet the standards for unobviousness. Accordingly, it is respectfully requested that the rejection under 35 U.S.C. 103 (a) be withdrawn.

D. Concerning Allowable Subject Matter

Applicants gratefully acknowledge the Examiner's finding that Claims 15, 17, and 20 contain allowable subject matter.

E. Conclusions

The Final Rejection in its generality takes an impermissible subjective approach to the prior art. For example, the Rejection states, "However, it seems clear that it would be considerably more than obvious to one of ordinary skill at the time the invention was made to look [at] the catalyst art in general rather than only to catalysts having identical ingredients, since many process steps tend to be generic to many references regardless of particular ingredients, such as heating, drying, precipitating, impregnating, and/or calcining." The opinion of the Final Rejection at best supports the conclusion that it might be obvious to try a well-known technique to solve a new problem. It is insufficient that one skilled in the art might find it

"obvious to try" combining the prior art references. *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987). Moreover, all evidence of non-obviousness (e.g., an indication of failure of impregnation as disclosed by EP-A1-0,709,360) must be considered. *In re Soni*, 34 USPQ2d, 1684, 1687 (Fed. Cir. 1995). Finally, patentability lies in the claim being "taken as a whole" including all of the claim elements and combination of process steps. *E. G. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1548; 220 USPQ 303,309 (Fed. Cir. 1983). In the case at hand, a key combination of claim elements involves the use of a reducing agent combined with impregnation.

The Final Rejection maintains that it is not persuasive for Applicants to argue that the chemical and catalyst arts are wide-ranging fields and notoriously unpredictable, "because the claimed limitation is disclosed in the prior art, not for some other purpose as Applicant appears to suggest, but specifically for use in a catalyst, and more specifically, a titanium catalyst." On the contrary, while analogy is at times useful, chemistry is essentially an experimental science and results are often uncertain, unpredictable, and unexpected. Catalytic effects are a particularly unpredictable aspect of the art of chemistry. *Corona Co. v. Dovan Corp.*, 276 U.S. 358 (1928); *In re Doumani*, 47 CCPA 1120, 281 F.2d 215, 126 USPQ 408 (1960). Iwakura discloses impregnation as only *one* element from dozens of other disclosed elements, mainly for use in preparing a silver/tungsten/cesium catalyst for use in an oxidation process that does not employ hydrogen. There is no indication as to which one of the many possible choices of any cited reference is likely to be successful in solving the problem that demanded Applicants' attention, namely, to find a commercially attractive preparation for a gold-titanium catalyst of acceptable activity and selectivity for use in an oxidation process in the presence of hydrogen. None of Haruta '394, Iwakura, or Hirose teaches, suggests, or hints at the selection of impregnation to be combined with use of a reducing agent as a solution to Applicant's problem. Without some indication in the cited references that such a combination might be desirable for the specific purpose, the selection of elements from non-analogous sources, in a manner that reconstructs the Applicants' invention only with the benefit of hindsight, is insufficient to present a *prima facie* case of obviousness. *Ex parte Dussaud*, 7 USPQ 2nd, 1818, 1820 (PTO Bd. 1988); *In re Grabiak*, 226 USPQ 870, 872 (Fed. Cir. 1985); *In re Fine*, 5 USPQ 2nd 1596, 1598 (Fed. Cir. 1988)

In view of the above, it is submitted that amended Claims 1 to 32 meet all of the requirements for patentability. Accordingly, Applicants respectfully request reconsideration of the Final Rejection. A Notice of Allowance is respectfully requested at the Examiner's earliest convenience.

Respectfully submitted,



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APPENDIX A - MARKED-UP VERSION OF AMENDED CLAIMS

Claim 1. (twice amended) A process of preparing a catalyst composition comprising gold on a titanium-containing support, for use in an oxidation process in the presence of hydrogen, the preparation process comprising impregnating a gold compound and a reducing agent onto a catalyst support, wherein the reducing agent comprises titanium, or the catalyst support comprises titanium, or both the reducing agent and the catalyst support comprise titanium, under conditions sufficient to prepare the catalyst composition.

Claim 11. (amended) The process of Claim 10 wherein the reducing agent is an organotitanium compound characterized by the presence of a titanium-carbon σ or π bond.

APPENDIX B - CLEAN VERSION OF AMENDED CLAIMS

B¹
SUB C1
Claim 1. (twice amended) A process of preparing a catalyst composition comprising gold on a titanium-containing support, for use in an oxidation process in the presence of hydrogen, the preparation process comprising impregnating a gold compound and a reducing agent onto a catalyst support, wherein the reducing agent comprises titanium, or the catalyst support comprises titanium, or both the reducing agent and the catalyst support comprise titanium, under conditions sufficient to prepare the catalyst composition.

B²
SUB C2
Claim 11. (amended) The process of Claim 10 wherein the reducing agent is an organotitanium compound characterized by the presence of a titanium-carbon σ or π bond.